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DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES
AND OTHER ARID-LAND PLANT COMMUNITIES

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16. Abstract Ground-truth measurements of plant coverage on 6 satellite over-flight dates reveal unique trends in coverage for the 5 desert or semi-desert communities selected. Densitometry and multi-spectral additive color viewing were used in a preliminary analysis of imagery using the Electronic Satellite Image Analyzer Console at Stanford Research Institute. The densitometric analysis shows promise for mapping boundaries between plant communities. Color additive viewing of a chronologic sequence of the same scene shown in rapid order will provide a method for mapping phreatophyte communities.					
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- a. Title: Dynamics of Distribution and Density of Phreatophytes and Other Arid-Land Plant Communities

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- c. Statement and explanation of any problems that are impeding the progress of the investigation: None

- d. Discussion of the accomplishments during the reporting period and those planned for the next reporting period:

Collection of field data. Plant coverage values have been estimated on 6 satellite overflight dates since early October. The 5 sites selected for quantitative plant coverage determination show unique trends in coverage, as had been anticipated. For example at the grassland site, a continuous decrease in plant coverage from 20% to 5% has occurred during October through December, in spite of favorable precipitation conditions during that time. This trend was predictable since the grass dominants of the community are active in the summer and respond little to winter rains. In contrast, a desert shrub community with a strong component of winter-growing annual plants has increased in coverage during the same three-month period from about 7% to 19%. The increase is expected to continue until April or May when the spring dry season commences. Another desert community with a poor annual plant flora has remained at a constant perennial shrub coverage of 10%, as expected. These unique patterns of change will provide the basis for mapping various plant communities provided the changes can be detected on ERTS imagery.

Elsewhere, at phreatophyte community sites, qualitative data have been gathered to document the seasonal changes in foliation among the principal species. All are now leafless, but beginning in February leaves will begin appearing on first one then another of the dominant plants. These sequential flushes of growth should be readily detected by the MSS imagery and will provide a ready means of identifying and mapping phreatophyte communities.

Photographs in regular color and color-IR have been taken at all sites as well as at various points in the nearby Santa Catalina mountains where seasonal changes in the montane plant communities (from 2,700' to 9,000' elevation) are being followed. In addition views of the plain below are taken from the mountain to simulate oblique aerial photographs.

Analysis of imagery. During the last week of November a trip was made to Stanford Research Institute to examine in detail the newly modified Electronic Satellite Image Analyzer Console (SRIIAC) and to establish an operating procedure with SRI personnel. The SRIIAC proved to be a powerful tool in detecting both subtle and pronounced vegetation changes across the landscape. A plan was worked out during the November visit to

obtain from SRI the following kinds of data for each 18-day ERTS cycle:

(1) Thirty-five mm color photographs of a color composite display of the entire "Tucson" frame showing in simulated color-IR the various study sites. These synoptic views will be the main base for constructing vegetation maps.

(2) Thirty-five mm color composite photographs of three separate areas from the same frame enlarged by the SRIIAC ~~zoom~~ enlargement feature. These photographs of greater scale will permit detailed evaluation of changes in phreatophyte and desert plant communities. These enlarged views will be particularly valuable in identifying phreatophyte communities which are often dense growths dominated by a single species.

(3) Densitometric tracings (in selected multispectral bands) of scan lines across several transects on both the full frame and enlarged scenes. The transects were selected to cross the boundaries between the various communities being studied. The densitometric values may be combined in several ways to enhance the reflectance from plants. For example, one particularly promising combination is MSS 6 minus MSS 5. (This combination plays upon the strong absorption by plants in MSS 5 and their strong reflectance in the MSS 6 band). Preliminary comparisons of this reflectance manipulation shows good correlation with on-the-ground plant cover changes. In addition, SRI will provide time-lapse movies for technical presentation and detailed analysis.

e. Discussion of significant scientific results and their relationship to practical applications or operational problems including estimates of the cost benefits of any significant results.

On the basis of the few high quality frames of imagery available during the visit to SRI in late November, the following can be concluded:

1) Densitometer tracings along transects crossing basin and range topography show fluctuations that are related to vegetative coverage. Unique signatures that express plant coverage semiquantitatively appear feasible by combining densitometric values from images in two or more spectral bands. This approach will prove particularly useful in defining vegetation boundaries.

2) Magnified images of two areas with heavy phreatophyte growth suggest that definition of areal extent of phreatophytes is feasible at optimum magnification. Identification of the plant species comprising the areas of dense growth awaits analysis of roughly a full year's imagery. This length of time is needed for the satellite to "view" the unique phenologic pattern of each species. Rapid sequential viewing of color additive scenes arranged in chronologic order should provide a means for readily discriminating both phreatophyte and upland communities.

Category designation: 1C, 1F, 7J.

f. A listing of published articles, and/or papers, preprints, in-house reports, abstracts of talks, that were released during the reporting period:

None

g. Recommendation concerning practical changes in operations, additional investigative effort, correlation of effort and/or results as related to a maximum utilization of the ERTS system:

No recommendations

h. A listing by date of any changes in Standing Order Forms:

Cloud cover constraint changed from 70% to 100% on December 7, 1972.

i. ERTS Image Descriptor forms: N/A

j. Listing by date of any changed Data Request forms submitted to Goddard Space Flight Center/NDPF during the reporting period:

None